FINAL REPORT

USDA-ARS
Southern Regional Research Center
1100 Robert E. Lee Boulevard
New Orleans, Louisiana 70124-4305

Gayle H. Davidonis (ADODR)
504-286-4273

Cooperative Research and Development
Agreement No. 58-3K95-8-655,
Managing for Earliness and Fiber Property
Variability in Pix and Non-Pix Treated
Cotton, with

BASF Corporation
P.O. Box 13528
Research Triangle Park, North Carolina 27709-3528

BASF Contract
John Hardin
919-547-2019

Award date July 1, 1998 through June 30, 2000

BASF CRADA
FINAL REPORT
"Managing for Earliness and Fiber Property Variability
in Pix and Non-Pix Treated Cotton"
Gayle Davidonis

BACKGROUND. Over a 4 yr period in MS, mepiquat chloride (MC) treatment increased yields and resulted in a slight increase in fiber length (Ebelhar et al., 1996). Mepiquat chloride-treated plants set more bolls at lower node and fewer bolls at upper nodes than untreated plants (Kerby et al., 1986). In a planting date study Cathey and Meredith (1988) found that MC caused fiber length increases across all planting dates but did not affect micronaire. It has been concluded that MC induces a water conservation behavior through its affect on plant leaf area and delays the onset of water stress in plants growing under water-deficient conditions (Fernandez et al., 1992). The objective of this research was to monitor differences in fiber properties by boll location in untreated and MC-treated plants from different planting dates.

Collaborators

The data presented in this report will focus on the 1999 crop with some reference to the 1997 crop. This project was possible with the cooperation of Juan Landivar, Carlos Fernandez, Bon Prince and Clinton Livingston.

MATERIALS AND METHODS

The planting date studies were conducted at the Texas A&M University Agricultural Research and Extension Center, Corpus Christi, TX in 1997 and 1999. One cultivar (DPL 5409) was used. The three planting dates for 1999 were 1 March (early), 22 March (normal) and 12 April (late). Pix was applied to early cotton (PD1) on 30 April at 7.4 oz/ac, normal cotton (PD2) on 13 May at 5.8 oz/ac, and late cotton (PD3) on 27 May at 7.0 oz/ac. The Pix concentration was 12 ppm.

The Pix concentration in 1997 was 38 ppm.

First position bolls were tagged on the day of flowering. Planting date 1 bolls were tagged on 20 May and 2 June. Planting date 2 bolls were tagged on 2 June and 11 June. Planting date 3 bolls were tagged 11 June and 17 June.

Fiber analysis was done using AFIS at the Southern Regional Research Center, New Orleans, LA. Fiber data collection was done by J. Brown and N. Criss. Fiber analysis was performed by K. Pusateri and statistical analysis was done by A. Johnson and D. Boykin.

Weather in 1997 and 1999

The rainfall pattern in 1997 was similar to the historical pattern in which June-July rainfall totalled 1.77 in. In 1999 the June-July rainfall was 6.09 in. Heat unit accumulation DD60 for June and July in 1997 was 1309 and 1265 for the same period in 1999.

RESULTS AND DISCUSSION

Yield

In 1997 and 1999 no differences in yield were found with MC treatment. In both untreated and MC-treated cotton yield decreased in late planted cotton (1997). In 1999 yields were higher than in 1997. In 1999 cotton yields did not decrease in late planted cotton. (Tables 1a and 1b supplied by C. Fernandez).

Plant maps

In 1997 no outstanding differences in plant maps between untreated and MC-treated plants were noted for PD2 and 3. Planting date 1 MC-treated plants had about 6% more bolls at FP1 nodes 3-7. In 1999 PD2 MC-treated plants had more FP1 4-7 bolls than untreated plants. (Table 2)

Boll weights and fiber properties

A comparison of boll weights for first position (FP1) bolls revealed that boll weight decreased for nodes 11-13 in PD2 and PD3 in 1997. No decrease in boll weight was noted in 1999 for untreated cotton (Table 3). In 1997 fiber length decreased with increasing node number for all planting dates, while in 1999 this trend was seen in PD1 and PD3. Theta (the degree of fiber circularity) a measurement of cell wall thickness did not change with location of first position bolls in both 1997 and 1999. In 1997 the highest theta values were reported for PD1 while in 1999 the highest values were for PD2. Micronafis values (AFIS equivalent of micronaire) did change with boll location in PD1 and PD2. Fiber perimeter (fineness) changed with node location in PD2. The longer fiber lengths in PD2 and PD3 bolls (FP1 node 11-13) can be attributed to increased rainfall in 1999. Micronafis values for PD2 and PD3 were higher in 1999 than in 1997.

Untreated and MC-treated cotton were compared within a planting date. When all boll locations were pooled MC-treated plants had fewer shorter fibers than untreated plants for the early planting date. In the drier year of 1997, MC increased fiber lengths in FP1 nodes 11-13 for all planting dates while in 1999 no changes in fiber lengths were observed in any planting date. It should be noted that Pix concentration was 38 ppm in in 1997 and 12 ppm in 1999. In 1997, MC treatment decreased theta values in FP1, 14> in addition to second position and vegetative bolls in PD1. In 1999, PD1 MC treatment decreased theta values in FP1, 14>. (Table 4). Mepiquat chloride treatment of PD2

cotton decreased theta values for FP1, 4-7 bolls (Table 5). Mepiquat chloride treatment of PD3 cotton decreased theta values for FP1, 14> bolls (Table 6).

Fiber lengths (2.5% span length) were increased from the first and second harvests of normal and late planted cotton while only the 50% span length measurement was affected by MC in the second harvest of early planted cotton (Cathey and Meredith, 1988). When fiber length was analyzed by boll location, FP1 bolls located at nodes 3-7 were not affected by MC. (1997). These bolls usually have the longest fiber when compared to other boll locations. (Table 3). If MC induces water conservation it might be expected that MC effects on fiber length would be more frequent in dry years.

Yield serves as an indicator of water input. In 1996, MC treatment did not alter yields. Yield for rainfed cotton was 313 lb/ac and for irrigated cotton was 955 lb/ac. Fiber properties were analyzed by first position boll location (flowering date) and it was reported that MC treatment decreased short fiber content (percent of fibers less than 12.7mm) in early season bolls (5 June flowering date) in rainfed and irrigated conditions. (Davidonis et al., 2000). Water conservation effects of MC may account for the increased theta and microafis values found in MC-treated cotton. (Davidonis et al., 2000). In 1997, MC increased theta values for PD3 cotton. The yields for PD3 in 1997 were 494 lb/ac for untreated cotton and 487 lb/ac for MC-treated cotton.

Tagged boll results

In 1997 bolls were tagged twice during the growing season. In 1999 each planting date had two tagging dates. A comparison of fiber properties from bolls tagged on the same date yields information on the effects of plant location on fiber properties. For PD1 first position bolls tagged on 20 May, bolls were found on nodes 8-11 and on 2 June, bolls were found on nodes 13-14. For PD2 first position bolls tagged on 2 June, bolls were found at nodes 6-10 and on 11 June, bolls were found at nodes 11-15. For PD3 first position bolls were tagged on 11 June and were found on nodes 6-9 and on 17 June, bolls were found on nodes 9-11. Pix treatment decreased fiber perimeter in PD2 bolls located at nodes 11-15. (Table 7). Boll location influenced fiber length when bolls tagged 2 June and 11 June were compared across planting dates but did not alter theta values for the 11 June tagging date. In 1997 MC decreased fiber perimeter in most of the tagged bolls and in two of the three cases the decrease in perimeter was associated with increased fiber length.

CONCLUSIONS

In the Coastal Bend area of Texas more rainfall is received normally in April and May and much less in June and July (1997). Rainfall amounts in 1999 were higher than normal. Planting as early as possible (1 March) in both 1997 and 1999 produced yields of 653 lb/ac and 940 lb/ac, respectively. Planting date 1 fiber quality was good in both years and mepiquat chloride treatment did not erode quality.

REFERENCES

Cathey, G.W. and Meredith, W.R. 1988. Cotton response to planting date and mepiquat chloride. Agron. J. 80:463-466.

Davidonis, G.H., Johnson, A.S. and Landivar, J.A. 2000. Effects of flowering date, irrigation and mepiquat chloride on cotton fiber properties. Proc. Beltwide Cotton Confs. pp. 626-628.

Ebelhar, M.W., Welch, R.A. and Meredith, W.R. 1996. Nitrogen rates and mepiquat chloride effects on cotton lint yield and quality. Proc. Beltwide Cotton Confs. pp. 1373-1378.

Fernandez, C.J., Cothren, J.T. and McInnes, K.J. 1992. Carbon and water economics of well-watered and water deficient cotton plants treated with mepiquat choloride. Crop Sci 32:175-180.

Kerby, T.A., Hake, K., and Keeley, M. 1986. Cotton fruiting modification with mepiquat chloride. Agron. J. 78:907-912.

Date of planting study

Table 1a: Average boll weight, turnout, first pick yield, second pick yield, total yield, and percent first pick by date of planting and treatment.

TAES, Corpus Christi, 1999

Date of planting	Treatment	Average boll wt. (g)	Average turnout (%)	1st pick yield (lbs/ac)	2nd pick yield (lbs/ac)	Total yield (lbs/ac)	Percent 1st pick
03/01	no pix	4.6	40.1	896.8	43.1	939.9	95.6
	pix	4.8	39.3	894.5	38.6	933.1	96.0
	LSD (P = 0.05)	0.39	1.33	51.39	12.20	62.38	1.23
	C.V.	3.67	1.49	2.55	13.28	2.96	0.57
	Pr > F	0.2010	0.1345	0.8958	0.3298	0.7524	0.3777
03/22	no pix	5.0	40.8	1005.2	143.7 a*	1148.9 a	95.9 a
	pix	4.9	41.0	932.2	40.8 b	972.9 a	87.6 b
	LSD (P = 0.05)	0.27	0.75	120.13	96.92	199.15	8.00
	C.V.	2.46	0.82	5.51	46.70	8.34	3.87
	Pr > F	0.4444	0.4105	0.1485	0.0431	0.0672	0.0446
04/12	no pix	4.6	39.2	964.1	116.6	1080.6	89.1
	pix	4.7	38.2	975.9	95.2	1071.2	90.9
	LSD (P = 0.05)	0.44	2.01	87.35	49.57	132.66	3.72
	C.V.	4.22	2.31	4.00	20.81	5.48	1.84
	Pr > F	0.6238	0.2120	0.6957	0.2640	0.8352	0.2210

*Means in a column, followed by the same letter, are not significantly different.

Date of planting study

Table 1b: Average boll weight, turnout, first pick yield, second pick yield, total yield, and percent first pick by treatment and date of planting.

TAES, Corpus Christi, 1999

Treatment	Date of planting	Average boll wt. (g)	Average turnout (%)	1st pick yield (lbs/ac)	2nd pick yield (lbs/ac)	Total yield (lbs/ac)	Percent 1st pick
no pix	03/01	4.6 b*	40.1 ab	896.8	43.1	939.9	95.6 a
	03/22	5.0 a	40.8 a	1005.2	143.7	1148.9	87.6 b
	04/12	4.6 b	39.2 b	964.1	116.6	1080.6	89.1 b
	LSD (P = 0.05)	0.30	1.18	167.73	65.11	203.69	5.85
	C.V.	3.69	1.70	10.15	37.22	11.14	3.73
	Pr > F	0.0443	0.0405	0.3453	0.0223	0.1090	0.0323
pix	03/01	4.8	39.3 b	894.5	38.6 b	933.1 b	96.0 a
	03/22	4.9	41.0 a	932.2	40.8 b	972.9 ab	95.9 a
	04/12	4.7	38.2 b	975.9	95.2 a	1071.2 a	90.9 b
	LSD (P = 0.05)	0.30	1.19	120.90	30.32	107.19	4.18
	C.V.	3.57	1.74	7.48	30.11	6.24	2.57
	Pr > F	0.2275	0.0031	0.3253	0.0061	0.0478	0.0387

*Means in a column, followed by the same letter, are not significantly different.

Table 2. Changes in plant maps related to planting date (PD).

	Untreated			Pix		
	PD1	PD2	PD3	PD1	PD2	PD3
Node Location	Percent bolls at each location					
FP1, 4-7	29.3	15.6	22.2	29.3	23.5	23.2
FP1, 8-10	32.1	25.3	21.6	35.2	37.7	28.3
FP1, 11-13	19.7	14.9	15.7	17.0	18.3	18.6
FP1, 14>	5.6	11.5	13.9	4.8	4.8	7.6
FP2	7.2	16.0	18.9	6.7	9.3	17.1
FP3>	0.4	1.1	4.1	0.4	0	1.8
Vegetative	2.0	12.3	2.7	6.7	6.3	3.7

Table 3. Boll weights and fiber properties for untreated cotton 1999

		AFIS Fiber Properties			
FP1 Location	Boll wt. (g)	L(w) mm	Theta	Micronafis	Perimeter (μm)
PD1					
4-7	4.26 a	24.6 a	0.505 a	4.54 b	54.5 a
8-10	4.54 a	24.1 a	0.507 a	4.58 b	54.5 a
11-13	4.00 a	23.1 b	0.521 a	4.86 a	54.8 a
PD2					
4-7	4.01 b	25.3 b	0.572 a	5.58 a	54.0 a
8-10	4.38 ab	25.9 b	0.573 a	5.46 ab	53.0 b
11-13	4.49 a	26.9 a	0.564 a	5.12 b	51.9 c
PD3					
4-7	3.98 a	27.7 a	0.526 a	4.69 a	52.8 a
8-10	4.04 a	26.2 b	0.523 a	4.69 a	53.3 a
11-13	3.87 a	25.4 b	0.520 a	4.61 a	53.0 a

Boll and fiber parameters were compared within a planting date (PD). Values followed by a different letter within a PD are significantly different at the $p = 0.05$ level.

Table 4. Fiber properties for planting date 1, 1999

	Length (mm)		Theta		Perimeter (μm)	
Node Location	Untreated	Pix	Untreated	Pix	Untreated	Pix
FP1, 4-7	24.6	24.1	0.505	0.500	54.5	54.5
FP1, 8-10	24.1	23.6	0.507	0.513	54.5	54.5
FP1, 11-13	23.1	23.4	0.521	0.495	54.8	54.8
FP1, 14>	24.4	24.6	0.570	0.518*	52.9	53.4
FP2	23.1	23.6	0.494	0.503	54.5	54.5

Untreated, Pix comparisons followed by *, **, ***, indicated significance at the p = 0.05, 0.01 and 0.001 levels respectively.

Table 5. Fiber properties for planting date 2 (1999)

	Length (mm)		Theta		Perimeter (μm)	
Node Location	Untreated	Pix	Untreated	Pix	Untreated	Pix
FP1, 4-7	25.3	24.4	0.572	0.529**	54.0	55.0
FP1, 8-10	25.9	25.1	0.573	0.554	53.0	53.7
FP1, 11-13	26.9	26.2	0.564	0.547	51.9	51.9
FP1 14>	26.4	24.9	0.584	0.567	51.1	52.7
FP2	24.9	24.6	0.545	0.526	53.2	53.8
Vegetative	26.2	25.9	0.564	0.536	52.8	52.5

Untreated, Pix comparisons followed by *, **, ***, indicate significance at the p = 0.05, 0.01 and 0.001 levels respectively.

Table 6. Fiber properties for planting date 3 (1999)

	Length (mm)		Theta		Perimeter (μm)	
Node Location	Untreated	Pix	Untreated	Pix	Untreated	Pix
FP1, 4-7	27.7	27.2	0.526	0.527	52.8	53.4
FP1, 8-10	26.2	26.7	0.523	0.520	53.3	53.1
FP1, 11-13	25.4	25.6	0.520	0.493	53.0	52.9
FP1, 14>	25.6	26.7	0.520	0.464*	52.6	51.9
FP2	25.6	25.6	0.497	0.476	52.9	52.8

Untreated, Pix comparisons followed by *, **, ***, indicates significance at the p = 0.05, p = 0.01 and p = 0.001 levels respectively.

Table 7. Comparison of untreated and Pix-treated cotton by flowering date (DOA)

		Length (mm)		Theta		Perimeter (μm)	
PD	DOA	Untreated	Pix	Untreated	Pix	Untreated	Pix
1	5/20/99	23.1	23.9	0.502	0.506	54.4	54.4
1	6/2/99	21.3	22.1	0.518	0.511	56.0	55.4
2	6/2/99	23.9	23.9	0.538	0.555	54.6	54.4
2	6/11/99	25.6	26.2	0.531	0.530	52.5	51.3**
3	6/11/99	27.7	27.7	0.531	0.531	52.5	52.7
3	6/17/97	24.4	25.1	0.534	0.538	53.9	53.7

Untreated, Pix-comparisons followed by *, **, ***, indicate significance at p = 0.05, 0.01 and 0.001 levels, respectively.